

What is claimed is:

29. A syringe comprising:

a barrel having a liquid drug reservoir therein, the barrel having a first end and a second end, the drug reservoir having a piston slidably engaged therein;

a needle assembly mounted at the first end of the barrel, the needle assembly holding a needle;

a nozzle sleeve moveably mounted on the first end of the barrel from a first position where the tip of the needle is concealed by the nozzle sleeve to a second position where the tip of the needle is exposed, to an activation position, wherein when the nozzle sleeve is initially pressed against an injection site, the nozzle sleeve moves from the first position to the second position, and the tip of the needle penetrates the injection site, and when the sleeve moves from the second position to the activation position, the piston drives a liquid from the reservoir into the injection site through the needle.

30. The syringe of claim 29, further comprising an energizing source located at the second end of the barrel; the energizing source in communication with the reservoir when the energizing source is activated to push the piston to drive the liquid.

31. The syringe of claim 30, wherein the energizing source is a gas generator.

32. The syringe of claim 31, wherein the gas generator includes a first chamber containing a citric acid solution and a second chamber containing a sodium bicarbonate solution.

33. The syringe of claim 31, wherein the gas generator includes a first chamber containing a carbon dioxide solution and a second chamber containing dry ice pellets.

34. The syringe of claim 30, further comprising an actuator extending adjacent to and in communication with the energizing source, the actuator activating the energy source to push the piston.

35. The syringe of claim 29, further comprising a flexible retractor located between the needle assembly and the nozzle sleeve, the flexible retractor biasing the nozzle sleeve to the first position.

36. The syringe of claim 35, wherein the retractor is a helical compression spring.

37. The syringe of claim 29, wherein the nozzle sleeve moves axially and rotationally relative to the barrel between the first position and the second position.

38. The syringe of claim 37, wherein the nozzle sleeve further includes a channel extending along an exterior wall of the sleeve, and the barrel further includes a peg extending inward from an inner wall of the barrel, the channel receiving the peg to cause relative rotational movement during relative axial movement between the barrel and sleeve, and having a shape that maintains the sleeve in a locked position to prevent further exposure of the needle after extraction of the fluid.

39. The syringe of claim 29, further comprises a needle cover frictionally engaged about the needle assembly to cover and protect the tip of the needle from contact.

40. A method of injecting liquid drug, comprising:

a) providing a barrel having a liquid drug reservoir therein and a delivery needle mounted on a first end of the barrel,

b) moveably mounting a sleeve within the first end of the barrel, the sleeve capable of assuming a first position where the tip of the needle is concealed by the sleeve, a second position where the tip of the needle is revealed, and a third position where the liquid drug is pushed from the liquid drug reservoir through the delivery needle;

c) pressing the sleeve against an injection site such that the sleeve moves from the first position to the second position and the tip of the needle penetrates the injection site; and

d) moving the sleeve to the third position to drive the liquid from the reservoir into the injection site through the delivery needle.

41. The method of claim 40, after step a), further comprising locating an energizing source at a second end of the barrel, the energizing source in communication with the reservoir for pushing a plunger to drive the liquid when the sleeve is in the third position.

42. The method of claim 41, wherein the energizing source includes a gas generator having first and second chambers, and further comprising mixing a first solution in the first chamber with a second solution in the second chamber when the sleeve is in the third position to create a force that pushes the plunger to drive the liquid.

43. The method of claim 42, wherein the first solution includes citric acid and the second solution includes sodium bicarbonate.

44. The method of claim 42, wherein the first solution includes carbon dioxide and the second solution includes dry ice pellets.

45. The method of claim 40, further comprising biasing the sleeve to the first position.

46. The method of claim 40, further comprising moving the sleeve axially and rotationally relative to the barrel between the first position and the second position.

47. A syringe comprising:

a barrel having a liquid drug reservoir therein, the barrel having a first end and a second end;

a delivery needle mounted on the first end of the barrel;

an energizing source located at the second end of the barrel; the energizing source in communication with the reservoir when the energizing source is activated;

an actuator extending adjacent to and in communication with the energizing source; and

a sleeve moveably mounted on the first end of the barrel from a first position where the tip of the needle is concealed by the sleeve to a second position where the tip of the needle is exposed, to an activation position, wherein

when the sleeve is initially pressed against an injection site, the sleeve moves from the first position to the second position, and the tip of the needle penetrates the injection site, and

when the sleeve moves from the second position to the activation position, the actuator activates the energizing source which drives a liquid from the reservoir into the injection site through the needle.

48. The syringe of claim 47, wherein the energizing source is a gas generator.

49. The syringe of claim 48, wherein the gas generator includes a first chamber containing a citric acid solution and a second chamber containing a sodium bicarbonate solution.

50. The syringe of claim 48, wherein the gas generator includes a first chamber containing a carbon dioxide solution and a second chamber containing dry ice pellets.

51. The syringe of claim 47, further comprising a flexible retractor located between the needle assembly and the nozzle sleeve, the flexible retractor biasing the nozzle sleeve to the first position.

52. The syringe of claim 51, wherein the retractor is a helical compression spring.

53. The syringe of claim 47, wherein the nozzle sleeve moves axially and rotationally relative to the barrel between the first position and the second position.

54. The syringe of claim 53, wherein the nozzle sleeve further includes a channel extending along an exterior wall of the sleeve, and the barrel further includes a peg extending

inward from an inner wall of the barrel, the channel receiving the peg to cause relative rotational movement during relative axial movement between the barrel and sleeve.

55. A method of injecting liquid drug, comprising:

- a) providing a barrel having liquid drug reservoir therein and a delivery needle mounted on a first end of the barrel;
- b) locating an energizing source at the second end of the barrel, the energizing source in communication with the reservoir when the energizing source is activated;
- c) moveably mounting a sleeve within the first end of the barrel, the sleeve capable of assuming a first position where the tip of the needle is concealed by the sleeve, a second position where the tip of the needle is revealed, and an activation position;
- d) placing the sleeve against an injection site;
- e) moving the barrel toward the injection site, thereby causing the sleeve to move from the first position to the second position and the tip of the needle to penetrate the injection site; and
- f) moving the sleeve to the activation position to activate the energizing source to drive a liquid from the reservoir into the injection site through the needle.

56. The method of claim 55, wherein the energizing source includes a gas generator having first and second chambers, and further comprising mixing a first solution in the first chamber with a second solution in the second chamber when the sleeve is in the third position to create a force that pushes the plunger to drive the liquid.

57. The method of claim 56, wherein the first solution includes citric acid and the second solution includes sodium bicarbonate.

58. The method of claim 56, wherein the first solution includes carbon dioxide and the second solution includes dry ice pellets.

59. The method of claim 55, further comprising biasing the sleeve to the first position.

60. The method of claim 55, further comprising moving the sleeve axially and rotationally relative to the barrel between the first position and the second position.

61. A syringe comprising:

a member having a liquid drug reservoir therein, the member having a first end and a second end;

a delivery needle mounted on the first end of the member;

an energizing source located at the second end of the member, the energizing source in communication with the reservoir when the energizing source is activated; and

a sleeve moveably mounted on the first end of the member from a first position where the tip of the needle is enclosed by the sleeve, to a second position where the tip of the needle is enclosed by the sleeve, to a second position where the tip of the needle is exposed, to a third position where the sleeve activates the energizing source, wherein

when the sleeve is initially pressed against an injection site, the sleeve moves from the first position to the second position such that the tip of the needle penetrates the injection site,

and when the sleeve moves from the second position to the third position, the energizing source drives a liquid from the reservoir into the injection site through the needle.

62. A method of injecting liquid drug, comprising:

- a) providing a member having a liquid drug reservoir therein and a delivery needle mounted on a first end of the member,
- b) locating an energizing source at the second end of the member, the energizing source in communication with the reservoir when the energizing source is activated;
- c) moveably mounting a sleeve within the first end of the member, the sleeve capable of assuming a first position where the tip of the needle is concealed by the sleeve, a second position where the tip of the needle is revealed, and a third position where the energizing source is activated;
- d) pressing the sleeve against an injection site such that the sleeve moves from the first position to the second position and the tip of the needle penetrates the injection site; and
- e) moving the sleeve to the third position to activate the energizing source to drive the liquid from the reservoir into the injection site through the needle.

63. An injection device comprising a housing, a nozzle assembly defining a fluid chamber, having an opening for slidably receiving at least a portion of the needle and being removably associated with the housing, a plunger movable in the fluid chamber, a trigger assembly, a force generating source operatively associated with the trigger assembly so that movement of the trigger assembly activates the energy source to move the plunger in a first

direction to expel a fluid from the fluid chamber, and a retractable injection-assisting needle at a distal end of the injector, said retractable injection-assisting needle comprising:

a needle tip located at a distal end of the needle with at least a portion configured and dimensioned to slide through the nozzle assembly opening;

10 a discharge channel within the needle tip and terminating in an orifice through which the fluid is expelled;

a body portion to direct fluid towards the discharge channel;

a plunger receptor configured and dimensioned to receive at least a portion of the plunger; and

a retraction element operatively associated with the nozzle assembly;

wherein the needle is located within the nozzle assembly in a retracted position prior to activation of the energy source; movement of the plunger in the first direction upon activation of the energy source results in at least a portion of the needle tip extending beyond the nozzle assembly opening; and the retraction element returns the needle tip to the retracted position after activation of the energy source.

64. The injection device of claim 63, wherein the retraction element moves to allow extension of the needle tip beyond the nozzle assembly opening and then returns to its original position to return the needle tip to its retracted position.

65. The injection device of Claim 64, wherein the retraction element is a spring.

66. The injection device of claim 63, wherein the needle body has an exterior surface which includes a ridge or recess for accommodating the retraction element.

67. The injection device of claim 63, wherein a shoulder is disposed between the needle tip and the needle body for accommodating the retraction element.

68. The injection device of claim 63, wherein the needle tip, when extended, has a length of approximately one to three (1-3) mm.

69. An injection device comprising:

- a housing having distal and proximal ends;
- a fluid chamber located within said housing for holding a medicament;
- an injection-assisting needle located in the distal end of said housing for delivering fluid from the fluid chamber;
- a plunger movable within the fluid chamber;
- a force generating source capable of providing sufficient force on the plunger to eject the medicament from the fluid chamber;
- a needle guard located at the distal end of said housing for concealing said needle, the needle guard being moveable between a protecting position and an injecting position; and
- an activation element operatively associated with the needle guard,

wherein retraction of the needle guard from the protecting position to the injecting position exposes the needle so that activation of the force generating source moves the plunger to expel medicament from said fluid chamber and thereby eject the medicament.

70. The injection device of claim 69, wherein retraction of the needle guard from the protecting position to the injecting position activates the force generating source and the force generating source provides sufficient force to eject the medicament in about three to five (3-5) seconds.

71. The injection device of claim 70, further comprising a locking element associated with the needle guard for locking the needle guard in the protecting position after activation of the injection device and after return of said needle guard to the protecting position.

72. The injection device of claim 69, wherein the needle is mounted on a needle holder operatively associated with the needle and the distal end of the housing, such that rotation of the needle holder places the needle in fluid communication with the fluid chamber.

73. The injection device of claim 69, further comprising a removable safety cap operatively associated with the distal end of the injection device such that rotation of the safety cap imparts rotation on the needle.

74. The injection device of claim 69, wherein the needle has a tip with a length of at least one to three (1-3) mm and the medicament is ejected at a at a pressure of about two atmospheres.

75. The injection device of claim 69, wherein at least a portion of the housing is made of a transparent or translucent material for allowing viewing of the fluid chamber.

76. The injection device of claim 69, wherein said fluid chamber comprises:
an ampule having a distal end, a proximal end and an opening in each of the distal and proximal ends;
a pierceable seal associated with the opening in the distal end; and
5 a stopper located in the proximal end of the ampule for maintaining the medicament inside the ampule.

77. The injection device of claim 76, wherein activation of the force generating source moves the pierceable seal towards the injection assisting needle to pierce the seal and moves the stopper to eject medicament from the injection assisting needle.

78. A method of delivering medicament to an injection site of a patient, comprising:
extending a needle from a shield prior to inserting the needle into the needle insertion point, said shield initially concealing the needle;

inserting the needle into the needle insertion point to a depth of about one to three (1-3) mm, with the needle being in fluid communication with a fluid chamber that contains the medicament; and

applying a force sufficient to eject the medicament from the fluid chamber and through the needle to deliver the medicament to the injection site,

wherein the needle insertion point is located more superficial than the injection site.

79. The method of claim 78, wherein the medicament is delivered in about three to five (3-5) seconds.